

# **Research and Development of Fuel Cells and Hydrogen in Japan**

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# Fuel Cell/Hydrogen Technology in Government Policies

- Science and Technology Basic Plan (Mar. 2006)
- New National Energy Strategy (May 2006)
- Basic Energy Plan (Mar. 2007)
  - Cool Earth – Innovative Energy Technology (Mar. 2008)  
Selection of 21 technologies as innovative technologies that should be given higher priority
- Next-Generation Automobile Fuel Initiative (May 2007)

*“Japan will aim to reduce its emissions by 25% by 2020, if compared to the 1990 level.”*

Statement by Prime Minister Yukio Hatoyama at UN Summit on Climate Change

*“Needless to say, solar panels, **fuel cells** and various other types of green technology need to be mobilized. **Hydrogen** energy is also likely to become available in the future.”*

Press Conference by PM Yukio Hatoyama following his attendance at meetings at the UN and the Pittsburgh G20 Summit

## “Hatoyama Initiative” (2009)



September 25, 2009 Press Conference

# “The New Growth Strategy”

“The New Growth Strategy” was issued this June.

Focusing on truly essential fields

Prioritizing policies and programs in each field

Avoiding duplication of similar programs (including cross-ministerial programs) in terms of “**selection and focus**”

aimed at settling on the subject surrounding Japan **at 2020.**

- We will spread and promote top-level environmental technologies in Japan by advancing “**green innovation**” (innovation in the environment and energy sectors) and with a comprehensive **policy package**.
- We will also aim at making Japan the foremost global environment and energy power.

## Policy package: Action Plan

(by Council for science and technology policy)

**“green innovation”**

**“life innovation”**

# “Action Plan” in green innovation

Toward becoming the world’s top environment and energy power through a comprehensive policy package. The climate change problem has already exceeded the range that can be addressed by individual element technologies. It is now essential to promote the creation of a low-carbon society through a comprehensive policy package including new systems design, systems changes, new regulations, and regulatory reform, and to support the rapid spread and expansion of environmental technologies and products.

Vision	Action	Policy Package
Aim at making Japan the world’s top environment and energy power through overcoming the climate change.	Transformation into renewable energy	①Promotion of transformation into renewable energy through photovoltaic power
		②Promotion of transformation into renewable energy through biomass.
	Low-carbon society	③Low carbon society through atomic power generation
		④Efficient use of fossil fuel
	Energy-conserving	<b>⑤Low-carbonization in the transportation through spreading next-generation vehicles.</b>
		⑥Energy conserving in office/residence
		⑦Low carbonization through utilization of information and communication technology
	Green cities	⑧Creation a lush greenery environment and natural circulation
		⑨Advance homes, transportation and environment of local areas

## **Policy package ⑤: Development of dramatic growth and reducing cost of Battery /Fuel Cell**

1. Development of High-performance Battery System for Next-generation Vehicles
2. Advanced Science Research of Innovative Battery
3. Development of PEFC Technologies for Commercialization Promotion
4. Fundamental Research Project on Advanced Hydrogen Science
5. Advanced Research on Hydrogen Storage Materials
6. Development of Technologies for Hydrogen Production, Delivery and Storage Systems



# “Basic Energy Plan”

**E**nergy security  
A stable supply of  
resources and  
energy.

Basic Energy Plan  
point of view: **3E**

**E**nvironment  
Powerful  
countermeasures to  
environmental issues:  
global warming.

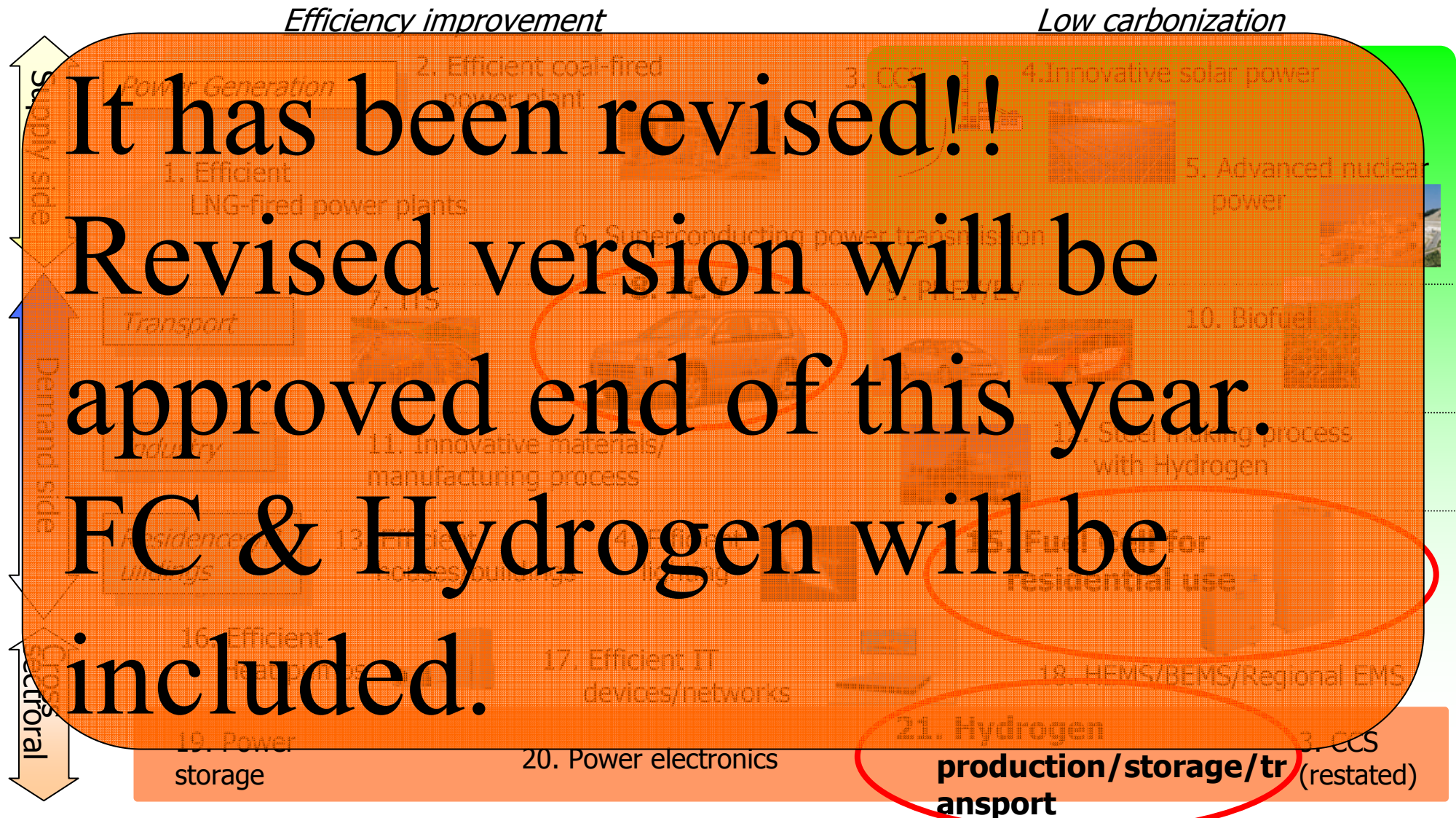
**E**conomic efficiency  
An efficient energy  
supply based on the  
proper function of  
the market.

- Energy is the foundation of citizens' lives and economic activities.
- The basis of energy policy is to aim at the realization of the three Es –**energy security** and **environmental suitability**, as well as **economic efficiency** that takes advantage of market functions while giving sufficient consideration to such security and suitability.



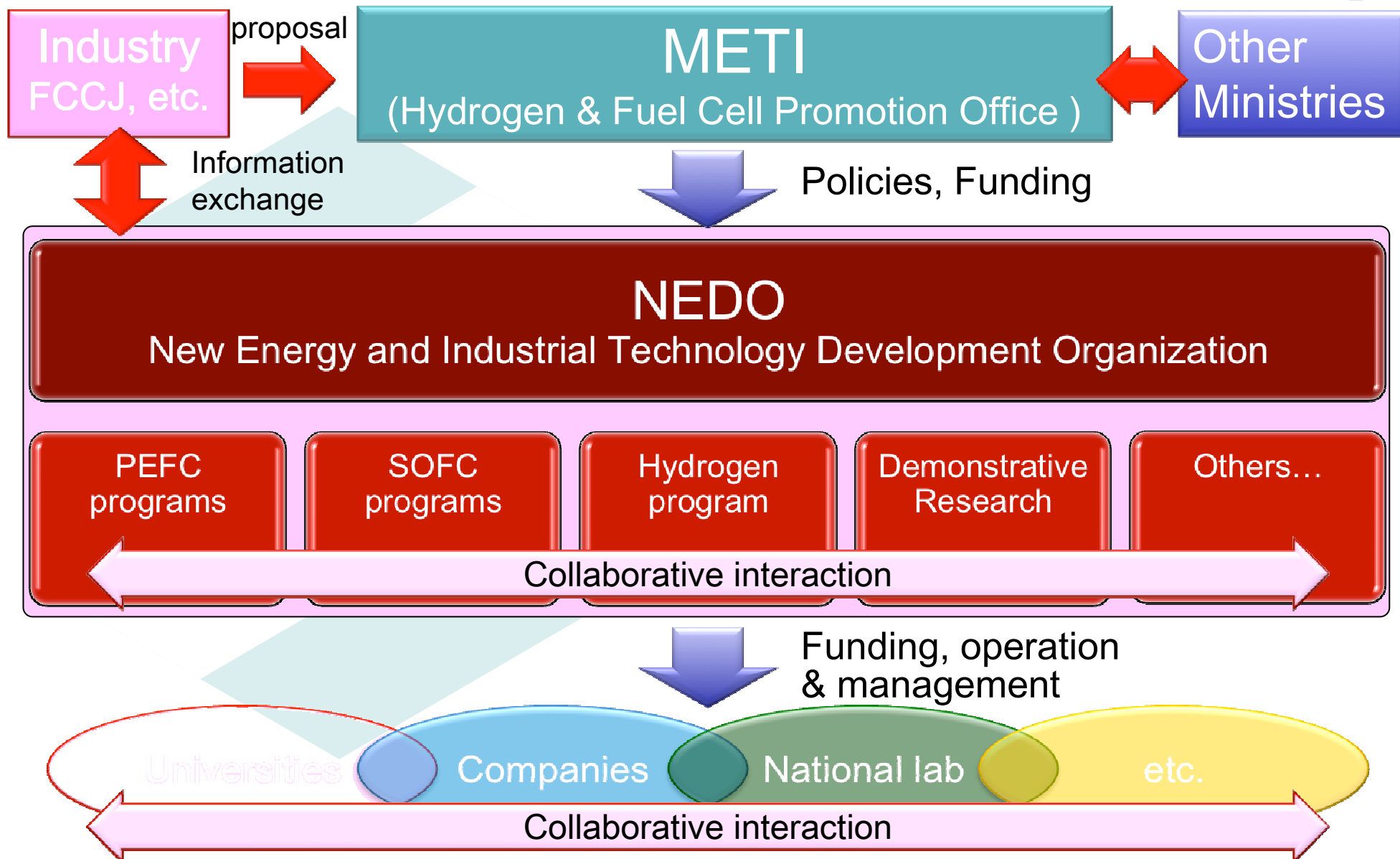
The New  
**G**rowth  
strategy

“Cool Earth – Innovative Energy Technology”

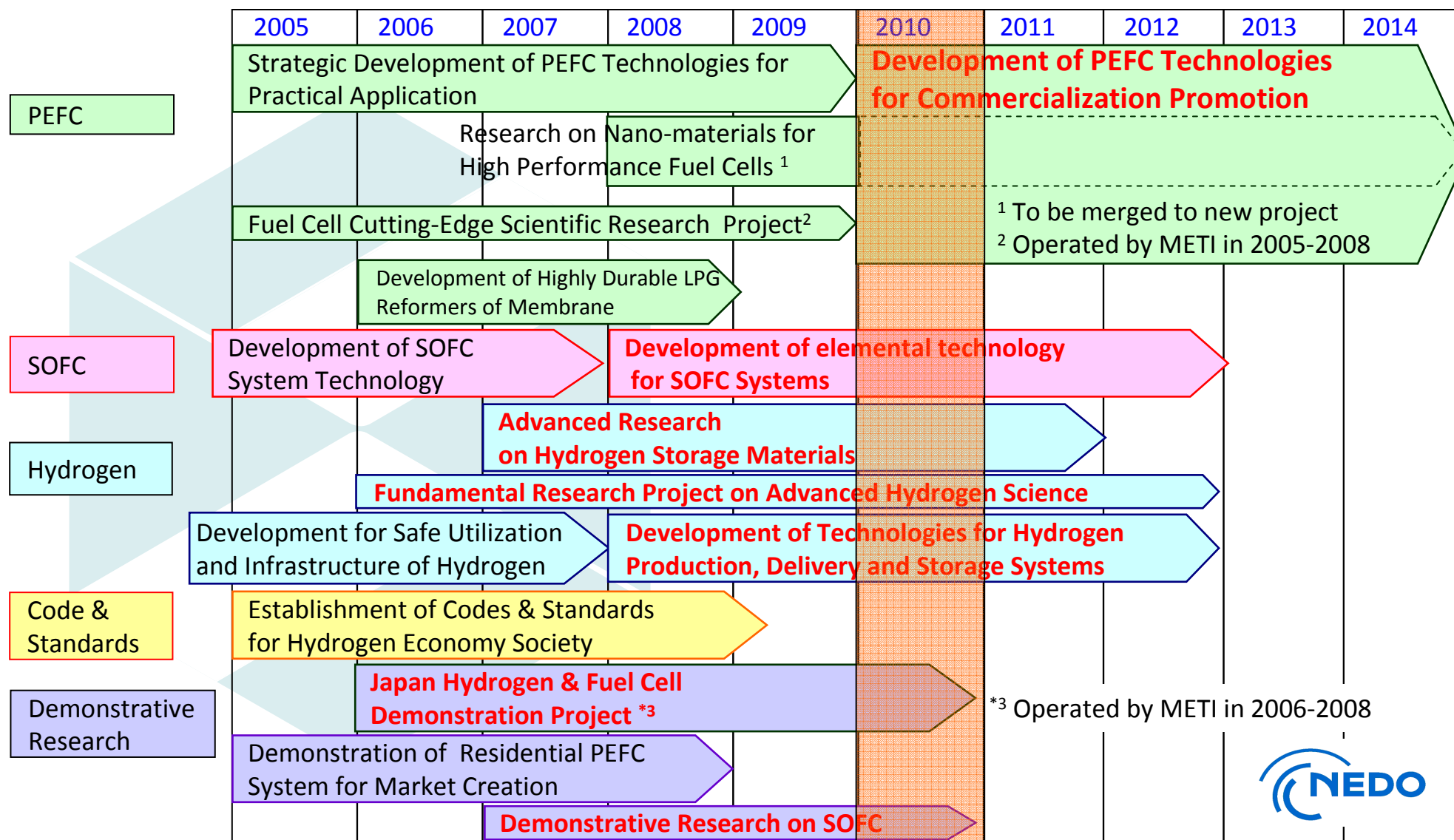




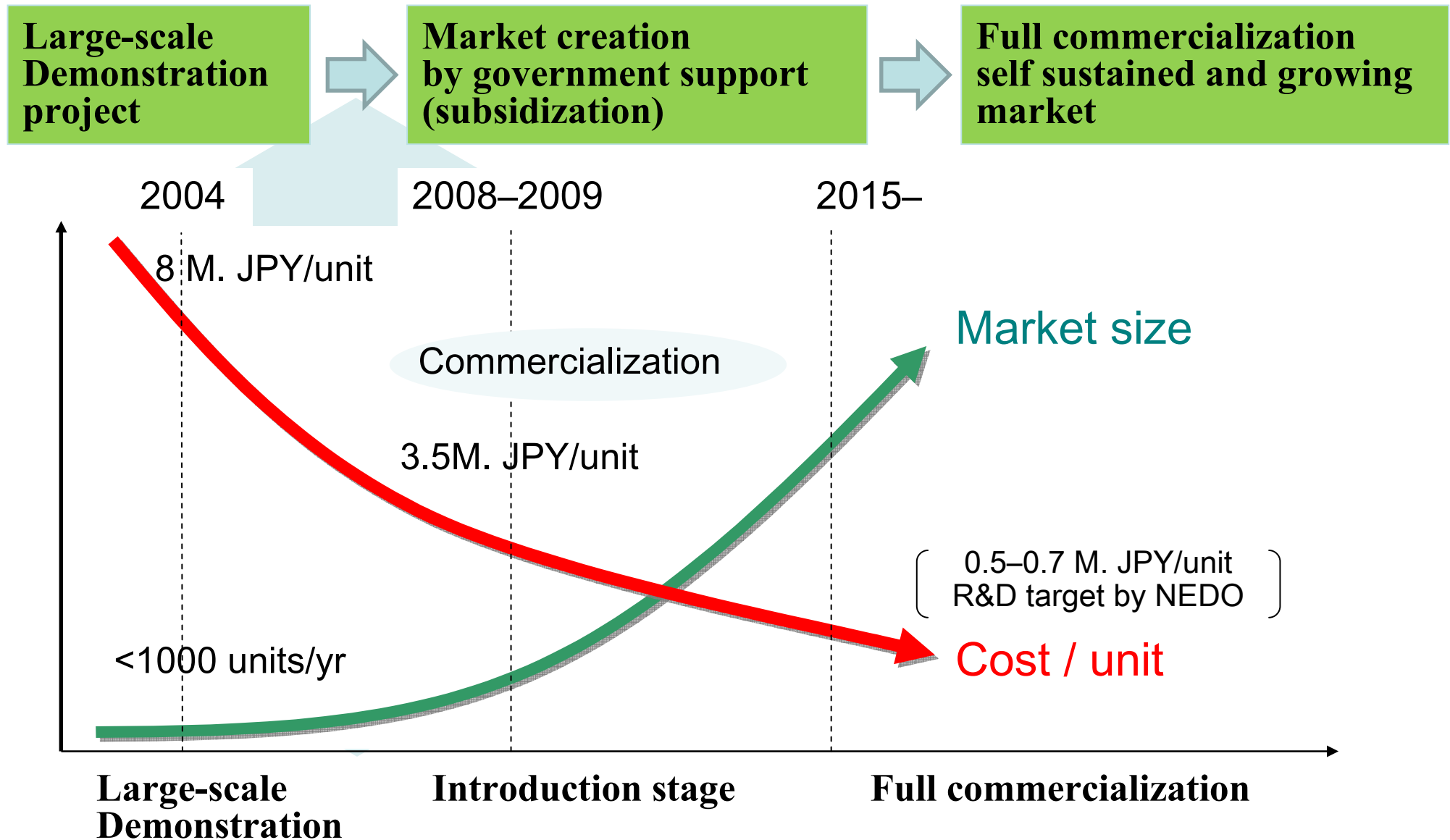
# Framework for R&D of Hydrogen and Fuel Cells under METI in Japan



# R&D on Fuel Cell and Hydrogen Technologies by NEDO



# Scenario of Market Creation for Residential Fuel Cell





# Commercialization of Residential Fuel Cells

Residential fuel cell systems commercialized in 2009.

- 0.7–1.0 kW PEFC + heat recovery (CHP)
- Three manufactures
- Subsidization program initiated

1/2 of users' costs (system + installation) up to 1.4M JPY

**Over 5,000 units were offered** (as of Mar. 2010)

(3,307 by demonstration project in 2004-2008)



**“ENE-FARM” - The unified logo  
for Residential Fuel Cells**



# SOFC Demonstration Project

To collect data and experience of practical operation of residential SOFC systems.

- Degradation by impurity
- Influence of current density, operating temperature
- Troubles of equipment



Durability improvement by modification of cell stack structure and system design

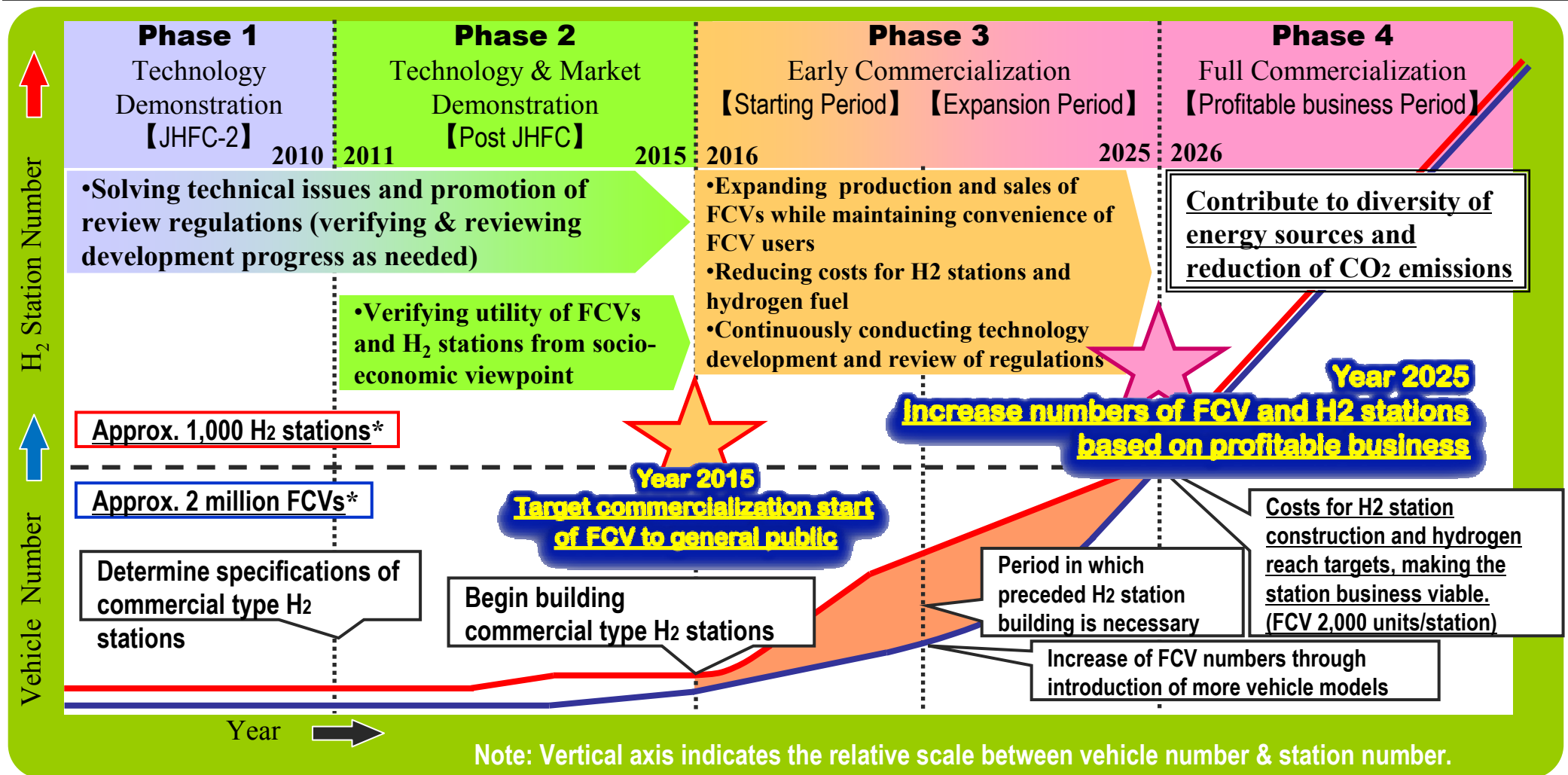
Project period: FY2007-2010

## Characteristics of SOFC

- High efficiency of electric power generation
- No expensive catalysts (Pt etc.) needed
- Mature ceramic technology applicable
- Scale-up



# FCCJ approved Commercialization scenario



2<sup>nd</sup> milestone is set in 2025 to contribute to reduction of CO<sub>2</sub> emissions.

Source : FCCJ

Approximately 1,000 H<sub>2</sub> stations and approximately 2 million FCVs are set as common perspective.

\* Precondition: Benefit for FCV users (price/convenience etc.) are secured, and FCVs are widely and smoothly deployed

# Japan Hydrogen & FuelCell Demonstration Project (JHFC Phase II)

- To clearly show energy-saving effect and environmental impact
- To collect data for codes & standards development and certification practices

- Demonstration of FCV under actual circumstances
- Hydrogen stations: upgraded to 70 MPa
- Demonstrative operation of various means of H<sub>2</sub> production and supply and its verification
- Awareness & education: To raise public awareness regarding FCVs and H<sub>2</sub> Stations
- Currently operating **14 hydrogen fuelling stations** and one hydrogen liquefaction facility in the Tokyo metropolitan area, Chubu area, Kansai area, and Kyushu area.

**\*Information!! The FY2010 9th JHFC International Seminar, Date : Feb 28(Mon.) -Mar 1 (Tue.), 2011**



# Report on the Long Distance Demonstration Drive of 1,100km (approx. 684 miles) by Three Fuel Cell Vehicles



TOYOTA FCHV-adv

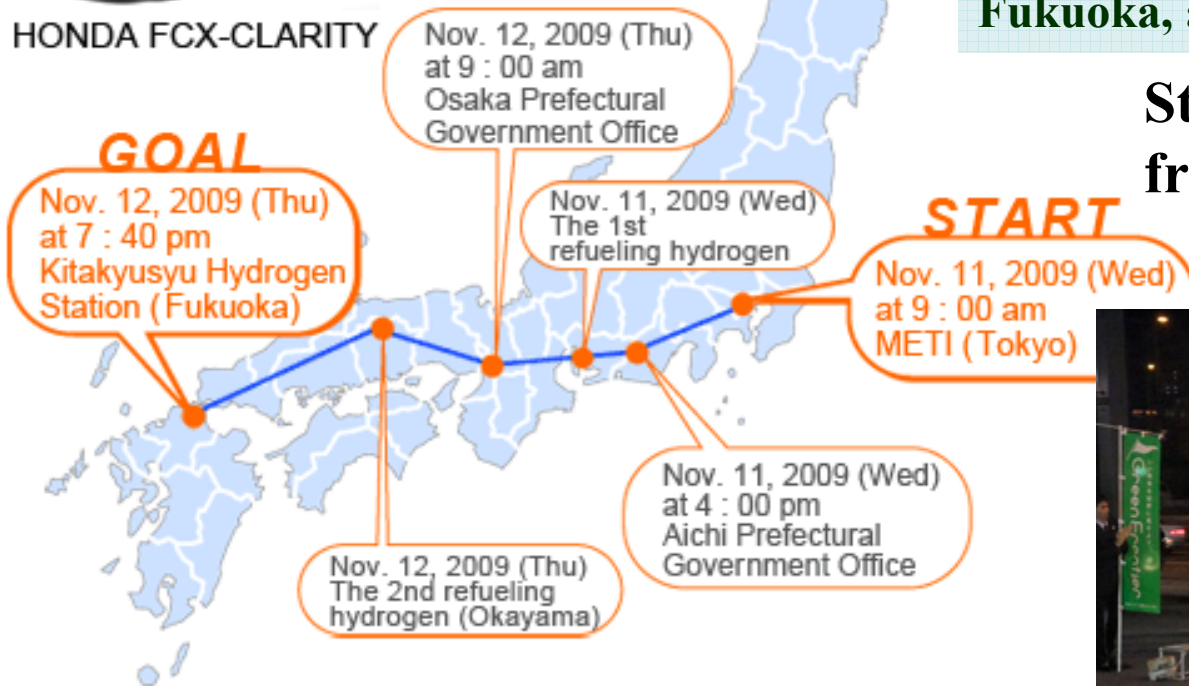


NISSAN X-TRAIL FCV



HONDA FCX-CLARITY

- The top-ranked vehicle in the project has recorded an efficiency of **61.3 percent** and a mileage of **159 km/kg of hydrogen** (Japan's 10-15 mode).
- From Wednesday 11 to Thursday 12 of November, 2009, three Fuel Cell Vehicles, attracting a lot of attention, ran the entire course from the Ministry of Economy, Trade and Industry, Tokyo to the Kitakyushu Hydrogen Station, Kitakyushu, Fukuoka, a distance of **1,100 km (about 684 miles)**.



Start  
from METI



Goal  
to Fukuoka



## Association of private companies on H<sub>2</sub> supply & utilization

- Verify hydrogen supply business by demonstrative research in societies
- Installations and operations of hydrogen infrastructures
- Operations and maintenance of hydrogen utilization such as fuel cell

**Members: 13 companies**

**Oil Utilities: Nippon Oil, Idemitsu Kosan, Cosmo Oil, Japan Energy, Showa Shell Sekiyu**

**Gas Utilities: Tokyo Gas, Osaka Gas, Toho Gas, Saibu Gas**

**Other companies (Industrial gas suppliers, hydrogen stations): Iwatani, Taiyo Nippon Sanso, Air Liquid Japan, Mitsubishi Kakoki Kaisha**

- Established on July 31, 2009
- FY2009–2015

## *Back to the basic*

**Basic research programs for innovation and breakthrough**

### **Polymer Electrolyte Fuel Cell Cutting-Edge Research Center**

**Project period: FY2005–2009**

**Head: AIST (FC-Cubic)**



### **Research Center for Hydrogen Industrial Use and Storage**

**Project period: FY2006–2012**

**Head: Kyushu Univ. and AIST Kyushu**



### **Advanced Fundamental Research on Hydrogen Storage Materials**

**Project period: FY2007–2011**

**Head: AIST**



### **Basic materials research for High Performance Fuel Cell**

**Project period: FY2008–2014**

**Head: Yamanashi Univ.**

**Hiper-FC**

# Concluding Remarks

- 1. The development of FCV and Hydrogen technology are important for the government policies of Japan.**
- 2. Residential fuel cell systems successfully started to be commercialized in 2009. Over 5,000 units were offered as of Mar. 2010.**
- 3. FCCJ approved 2<sup>nd</sup> milestone of FCV and hydrogen station is set in 2025 to contribute to reduction of CO<sub>2</sub> emissions.**
  - 1. Approx. 1,000 H<sub>2</sub> stations and approx. 2 million FCVs are set as common perspective.**
- 4. JHFC demonstrated the Long Distance Demonstration Drive of 1,100km (approx. 684 miles) by Three Fuel Cell Vehicles**
- 5. Basic research programs for innovation toward full commercialization of FCV is also important.**



**Thank you  
for your attention !!**